

THE PUPATION OF *ANTHOCHARIS*

By CHARLES F. COWAN*

Has no one yet described the pupation of *Anthocharis*? I can find no reference to it in any of our butterfly books. Every hair on the larva may be recorded for each instar, yet the pupa gets little more notice than detail of its colour and size. The process of pupation is probably the most traumatic, and one of the most dramatic times in the insect's life, and surely has a bearing on evolution and classification.

I first became interested in this in 1969 when, looking at the pupa, I wondered what on earth the long beak or snout above the eyes was for. It is reminiscent of *Libythea*, yet the *Anthocharis* butterfly has no vestige of a snout or beak (and conversely the *Libythea* pupa has little trace of one). I watched the emergence of the butterfly and was no wiser; the beak was quite empty. So I had to wait another year to watch pupation, and found that the thing was neither a beak nor a snout, but a horn! I did get one snap then, but had to wait until 1980 to secure a series covering the event (see Plate II).

Our little Orange Tip *A. cardamines* (L.) has its larval existence on a Crucifer plant[†] living first on the flower where the eggs are laid, and eating down to mature on the older seed capsules. Then it wanders away to search for a sound pupation site. This will usually be about 30cm above ground on a sturdy, nearly vertical, stem of about 6 or 7 mm diameter. In captivity I find the strong urge to wander at this stage is overcome by supplying one of the green quarter-inch stakes sold for supporting bulbs growing in bowls, which the larva will adopt at once if the stake is firmly set, even if it is cut down to only 15 cm long.

Head-down, the larva prepares a silk platform and then, head-up, slings its girdle. Then it rests for probably two days (fig. 1), awaiting a reasonably warm morning for its ordeal. Occasionally it gives a couple of twitches, and near the end of its wait a few minute drops of brown, viscous liquid fall from its mouth. Then, without warning, the drama begins. As the skin splits dorsally and, assisted by vigorous writhings, slips down the front of the head and feet, it reveals a small horn folded down the front of the face (fig. 2). The writhings are so energetic that the horn often hits the stick quite hard. The horn quickly grows, and rises erect (figs. 3-6). Five minutes from the commencement of the skin splitting, it is heaped at the lower end of the abdomen and the pupa starts a fresh series of writhing contortions to disengage the exuviae (fig. 6). They continue for some time after the skin drops; an instinctive act to "ensure" their discard, although not always successful. There follow some twists to adjust the girdle as the pupa adopts its familiar pose (figs. 7, 8) before it gradually loses all trace of suppleness. Unlike the pupa of, say, *Pieris* or *Artogeia*, that of *Anthocharis* cannot wriggle its abdomen; it is solid from horn to tail.

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The Plate shows the scale for figures 1 - 8, photographed in Cumbria in July 1980, the date and timings being:—

Fig 1,	17th. 0740	Note droplet oozing from mouth
Fig 2 - 5,	1045-1050	Skin splits and slides down as horn rises
Fig 6,	1051	Instant of skin drop
Fig 7,	1130	Home, and
Fig 8,	19th. pm	— nearly dry
Fig 9,	—	Duponchel, 1832 (see text, at end).

The pupa is bright green at first, but after about two days it usually fades slowly to a pale dull brown. A very few (?5 percent) remain green throughout. I have known four such; two found in the wild and both very conspicuous; one among dry stems in a Hertfordshire garden in the winter of 1970 and the other on a quarter-inch twig low down on an Ivy clad wall, in the lane only 100 yards from my back-door here in Cumbria in August 1980. I have also had two among reared examples in the past. None of these in any way "blended with their surroundings" as they are popularly supposed to do. I suspect that the green pupae, if not genetically controlled, may be "throw-back" relics of the past when, perhaps, the species may have been bivoltine; when the summer brood may have worn the green. I wonder how often this character occurs in South Europe and elsewhere in Palaearctica.

So what is the pupa horn for? It must serve a purpose or it would long since have been lost. The only solution I can yet offer is that it is a protective device against the hazards of its ten-month pupal period. Other Pierids spend far less time as pupae, they are supple, and they have heavy, blunt heads with much shorter horns or spikes. The long, slender *Anthocharis* pupa is rigid and arched in a beautiful cantilever. Its horn will fend off and deflect nearby waving vegetation and falling debris, and might even break up snow or ice sliding down the support. A remote possibility is that, in its early, downcurved moments, it acts as a buffer to protect the formative face from bumping the stem while the pupa writhes to shed its skin. But it is hard to believe that it was evolved solely for that purpose.

"Protective resemblance" has been suggested. Frohawk was so obsessed with the notion that he said, no less than three times, on three successive pages, of his great and beautiful 2-volume "Natural History" (1924: 1: 37-39) that the pupa resembled a "seed-pod", once going so far as to say "in both form and coloration it so closely resembles a seed-pod that it almost defies detection". But the pupa is seldom slung among seedheads; it deliberately deserts them. They will not survive the winter. Protective resemblance can only be invoked by saying that the pupa resembles the stump of a twig; and the horn adds little or nothing to that resemblance. The mystery remains.

One minor mystery is noted. The habits in Europe were queried above. In (Godart &) Duponchel * (1832, *Iconogr. des Chenilles des Lépid. de France* 1: 54, pl. 3, fig. 10b) is shown an extraordinary

example of a green pupa (reproduced here at fig. 9.). Of it, Duponchel only says that it overwinters as a pupa, and that the horn is often bent over (*souvent recourbée*). Is it? The plate is vouched for by that experienced artist Paul Dumenil, but Duponchel's footnote on his page 6 suggests that there was some muddle over his earlier artists, and Dumenil's signature may merely indicate a faithful engraving from an unidentified original. My first reaction was that the figure represented a half-way stage in the transformation, but that cannot be since the wing-cases are quite mature. In Boisduval's contemporary work (with Rambur & Graslin, when the name *Anthocharis* was introduced) a fuller and more accurate account is given, and a normal pupa is well figured by the artist Blanchard.

* Godart's name is on the title page, out of deference, and the work is always catalogued against his name, although he died in 1825 and Duponchel alone was responsible for publishing volume 1. Guenée assisted in completing volume 2 (Moths), and his name was added to the replacement title pages issued for each volume in 1849, three years after Duponchel's death.

THE DARK SWORDGRASS: *AGROTIS IPSILON* HUFNAGEL IN MARCH. — Although Bretherton, Goater & Lorimer (*Moths & Butterflies of Great Britain & Ireland*, Vol. 9) say this species has been recorded in every month of the year save January and February (South says one at least in February), I see that Evans & Evans (*Macrolepidoptera of Croydon*) regarded 12th May 1971 as a date early enough to be worthy of mention. So two in 1981 on March 10 in my actinic light trap here seem to be worthy of record. They were accompanied by a single *Eupsilia transversa* Hufnagel, a species frequent here last autumn at ivy bloom. Since starting the trap in 1978, I recorded several *A. ipsilon* in the autumn of that year and of 1979. In 1980, two came in June and six in August/September, all singletons.

The three nights previous to March 10 this year had produced nil results, though the same weather had continued during this period — a moderate SW wind bringing persistent cloud with rain on and off and temperatures steady between about 10 and 11 degrees C. throughout. I assume that such a record would be regarded as immigrant and not native emergence. The London Weather Centre informed me today that these winds derive from the area of the west coasts of Spain and North Africa and the Canary Islands.

Incidentally, I noted that the antennae of these two moths had male bipectination which very noticeably tapered abruptly halfway leaving the distal half filiform. Bretherton *et al.* above do not mention this but merely describe the male antenna as "strongly bipectinate", although filiform tips are described for some other *Agrotis* species. — R. A. Softly, 12, Parliament Court, Parliament Hill, London N.W.3 2TS, 11.iii.1981.